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Invasive Species Biology, Control, and Research

Part 2: Multiflora Rose (*Rosa multiflora*)

Michael L. Denight, Patrick J. Guertin, Dick L. Gebhart, and Linda Nelson

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Abstract: A 2007 Report to Congress documented a crucial factor in the loss of Army training land: uncontrolled vegetation growth. Of the 53 installations surveyed for the report, 30 reported that approximately 12 percent of their training lands were unusable for certain types of training. Uncontrolled vegetation was a source of such problems as an inability to conduct mounted and dismounted maneuver training, interference with equipment used in line-of-sight training, safety issues, and damage to equipment and structures. Of the 11 plant species (or groups) identified by installations as "uncontrolled vegetation," six were invasive plants, of which the two invasive plants most commonly identified were Kudzu (Pueraria montana) and Multiflora Rose (Rosa multiflora). This work provides a snap-shot of current research and scientific knowledge related to the invasive plant species Multiflora Rose, its impact on the Army, and a concise representation of control technologies for military land managers.

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Preface

This study was conducted for Office of the Assistant Chief of Staff for Installation Management (ACSIM), Environmental Division under Project A896, "Base Facility Environmental Quality," Army Invasive Species Priority Control and Management. The technical monitor was Dr. Victor Diersing, (DAIM-ISE).

The work was managed and executed by the Ecological Processes Branch (CN-N) of the Installations Division (CN), Construction Engineering Research Laboratory (CERL). The CERL principal investigator was Patrick J. Guertin. Alan Anderson is Chief, CEERD-CN-N, and Dr. John T. Bandy is Chief, CEERD-CN. The associated Technical Director was William d. Severinghaus, CEERD-CV-T. The Director of ERDC-CERL is Dr. Ilker R. Adiguzel.

CERL is an element of the U.S. Army Engineer Research and Development Center (ERDC), U.S. Army Corps of Engineers. The Commander and Executive Director of ERDC is COL Richard B. Jenkins, and the Director of ERDC is Dr. James R. Houston.

Unit Conversion Factors

Multiply	By	To Obtain
acres	4,046.873	square meters
degrees Fahrenheit	(F-32)/1.8	degrees Celsius
feet	0.3048	meters
gallons (U.S. liquid)	3.785412 E-03	cubic meters
inches	0.0254	meters
miles (U.S. statute)	1,609.347	meters
ounces (U.S. fluid)	2.957353 E-05	cubic meters
yards	0.9144	meters

1 Introduction

Background

A 2007 Report to Congress documented a crucial factor in the loss of Army training land: uncontrolled vegetation growth. Of the 53 installations surveyed for the report, 30 reported that approximately 12 percent of their training lands were unusable for certain types of training. The report cited uncontrolled vegetation as a source of such problems as an inability to conduct mounted and dismounted maneuver training, interference with equipment used in line-of-sight training, safety issues, and damage to equipment and structures (Office of the Assistant Secretary of the Army 2007).

Of the 11 plant species (or groups) identified by installations as "uncontrolled vegetation," six were invasive plants, of which the two invasive plants most commonly identified were Kudzu (*Pueraria montana*) and Multiflora Rose *(Rosa multiflora)*. Both species were introduced from Asia into the United States and were used extensively for conservation purposes in the 1930s through 1950s. Since that time, it has been widely recognized that both species are highly invasive in many areas of the Eastern United States.

Objectives

The objective of this work was to provide a snap-shot of current research and scientific knowledge related to the invasive plant species Multiflora Rose, its impact on the Army, and control technologies. The effort is intended to satisfy two goals: (1) to provide control and research information for ERDC-CERL direct funded program development, and (2) to provide a concise representation of control technologies for military land managers.

Approach

This work began with a literature review of pertinent materials related to control technologies for Multiflora Rose from sources including (but not limited too): scientific literature, government/university extension services, and Department of Defense, Army and ERDC technical and programmatic documents. This was supplemented with representative data from ongoing research to demonstrate potential future developments and opportunities in control technologies.

Scope

Information presented in this report was current at the time of publication. Invasive weed control methodologies, points of contact, and similar information may change over the course of time as scientific developments progress.

Mode of technology transfer

Information from this report will be disseminated as an ERDC/CERL report to military personnel and other interested parties. This report will also be made accessible through the World Wide Web at:

http://www.cecer.army.mil

2 Overview of *Rosa multiflora*

Plant information

Name: *Rosa multiflora* Thunberg ex Murray

Synonym: *Rosa cathayensis* (Rehd. & Wilson) Bailey

Family: Rosaceae

U.S. Department of Agriculture (USDA) Symbol: ROMU

Tier 1 Installations: Fort Bragg, Fort Campbell, Fort Knox, Fort Hood, Fort Leonard Wood, Fort Polk, Fort Riley, and Fort Sill

Nativity: Introduced for all reporting installations.

State Noxious Status: Listed as noxious weed at Fort Campbell, Fort Knox, and Fort Leonard Wood

Biology

Multiflora Rose (*Rosa multiflora*) is in the Subfamily Rosoideae, Tribe Roseae. The only known genus in the Tribe Roseae is *Rosa*. The common genera that are most closely related to *Rosa* are *Rubus, Fragaria, Geum, Potentilla, Adenostema, Purshia, Cercocarpus, Dryas, Alchemilla, Agrimonia,* and *Poterium*.

Multiflora Rose is native to eastern Asia (Korea, Japan, and China) but it has adapted to many North America habitats (Doll 2006). It is a stout, short, thorny, diffusely branched, perennial shrub with numerous arching canes arising from the crown. Multiflora Rose is easy to distinguish from nearly all the wild roses because of its large size and its numerous, recurved thorns (Doll 2006). Individual plants can reach 6.5m in diameter at a height of 3m in full sunlight. In shady conditions, canes can grow on other trees and may reach lengths in excess of 6m. Some of the tips of the canes may touch the soil allowing roots to form under certain conditions. The stems are green to reddish in color and the many thorns can tear flesh

and clothing easily. Leaves of the plant are pinnately compound, with 5 to 11 leaflets. Large, fringed stipules occur at the base of the leaf petiole.

Multiflora Rose flowers from late May to June and is pollinated insects. The inflorescence generally has 25 to 100 panicles with fragrant flowers that each have five whitish to whitish-pink petals (Figure 1). Once pollinated, the plant forms single-seeded achenes with hard seed coats that are resistant to damage. Fruits are fleshy, berry-like hips that become bright red in color (Figure 2). Hips do not split open to release seeds, but become leathery and may remain on the plant through the winter.

On average, each Multiflora Rose hip contains seven to eight seeds, resulting in the potential seed output of up to 500,000 seeds for each plant per year (Amrine 2002). Each seed weighs approximately 6 to 9 mg resulting in 50,000 to 80,000 seeds per pound (Meyer 2006). The germination of Multiflora Rose seeds is a complex process that involves changes at the pericarp, teste, and embryo levels (Meyer 2006). Furthermore, the degree of dormancy can vary among cultivars, seedlots, and even among hips on a single bush. Under natural conditions, a single winter season seems to be sufficient to break Multiflora Rose dormancy (Doll 2006).

Most plants develop from seeds that fall relatively close to the parent plant, but seeds are also dispersed by birds and mammals that consume them. Seeds may remain viable in the soil for 10 to 20 years, however, data are lacking about seed longevity and germination under field conditions. Seed germination may also be enhanced by scarification from passing through the digestive tracts of birds (Munger 2002).

Figure 1. Multiflora Rose in flower (photo used courtesy of the Wisconsin State Herbarium and Kenneth J. Sytsma, University of Wisconsin-Madison).

Figure 2. *Rosa multiflora* berries.

The hips of Multiflora Rose are consumed by many bird species, particularly American robins and cedar waxwings, but also by grouse, pheasants, and wild turkeys (White and Stiles 1992). Mice, rabbits, white-tail deer, and chipmunks also eat Multiflora Rose hips, especially in the winter when other food sources are scarce. The consumption of the seeds by animals leads to seed dissemination as they pass through and leave the digestive system.

For the first year or two, Multiflora Rose seedlings grow inconspicuously, but quickly become well anchored. Multiflora Rose reproduces asexually by suckering and layering once the tips of the canes grow long enough to touch the soil. It is a common belief that Multiflora Rose has a spreading root system, but this is not true. After the plants have become established, multiple stems arise from the root crown; to physically remove the plants, the entire root crown must be excavated from the soil. This means digging to at least a 6-8 in. depth to remove the roots.

Distribution

Multiflora Rose was introduced in the United States in the late 1800s as an ornamental plant, but it was used from the 1930s to the 1950s for conservation and wildlife benefits as a “living fence” (Doll 2006). West Virginia planted more than 14 million plants during this time. The original plantings gave rise to seeds that were disseminated beyond the deliberate cultivation sites. Multiflora Rose is estimated to infest more than 45 million acres in the eastern United States (Loux et al. 2005). Multiflora Rose occurs throughout eastern North America from Newfoundland south to northern Florida and west to Minnesota, Nebraska, and Texas. It can also be found along the North American west coast from British Columbia to California. In total, 38 states in the contiguous United States report the existence of Multiflora Rose.

Multiflora Rose is a designated noxious weed in Missouri, Wisconsin, Kentucky, Pennsylvania, Virginia, and West Virginia, a secondary noxious weed in Iowa, and a county-level noxious weed in Kansas (Munger 2002). It is a regulated non-native species in South Dakota and is listed as a regulated species in Ohio. Wisconsin and Maryland list it as a nuisance species. Tier 1 Army installations that list it as occurring on post are Fort Bragg, Fort Campbell, Fort Knox, Fort Hood, Fort Leonard Wood, Fort Polk, Fort Riley, and Fort Sill (Denight and Busby 2007). Nearly every state that is infested with Multiflora Rose is now working to contain this invasive plant and to rehabilitate affected lands.

Quantitative studies are needed to assess impacts caused by Multiflora Rose on native ecosystems (Munger 2002). Information about the rate of spread and the displacement of native plants is lacking, although a few studies report impacts to native plant recovery rates (Vidra et al. 2007).

Habitat

Multiflora Rose is adapted to undisturbed areas, such as roadsides, old fields, pastures, fence rows, right-of-ways, stream banks, recreational lands, and forest edges. It does particularly well on steep hillsides and is most productive in sunny areas with well-drained soils (Munger 2002). Multiflora Rose can tolerate a wide range of soil and environmental conditions, however, it is not found in areas with standing water or extremely dry areas. It is described as moderately winter hardy (USDA hardiness zones 5 to 8), and its northern distribution is limited by intolerance to extreme cold temperatures.

In open areas, Multiflora Rose grows as isolated plants, but it also grows in dense, impenetrable thickets in partially shaded areas and on sloping sites (Doll 2006). Individual plants may live indefinitely unless killed by human or natural means, but the biology and ecology of Multiflora Rose are not well-studied. More research is needed to better understand its life history, biological traits, habitat requirements and limitations, and its interactions with native U.S. flora and fauna (Munger 2002).

3 Control and Management

Effective control of Multiflora Rose requires persistent effort and a determined management plan. Regardless of the methods chosen, well established populations will unlikely be eradicated with a single treatment. Since seeds are continually imported by birds and other animals and the seeds remain viable in soils for many years, effective management requires post-treatment monitoring; spot treatments will be necessary for several years to prevent reinvasion (Kay et al. 1995).

Primary control sciences

Mechanical control

Removal of individual plants by pulling plants from the soil is only effective when all of the roots are removed, or when all of the subsequent plants arising from roots left behind are destroyed. This approach is best used in areas of light infestation. Bulldozing can be used to remove plants in areas of severe infestation, but the resulting ground cover loss and soil disturbance will greatly increase soil erosion potential.

Repeated defoliation will eventually kill Multiflora Rose and mowing several times during the growing season will eventually reduce the population (Loux et. al 2005). The recommended mowing regime is three to six times per year, repeated for 2 to 4 years, which will achieve an effective plant kill. Studies indicate that this type of mowing regime will, on average, result in 78 percent plant death rates by the third year, and up to 94 percent by the end of the fourth year (Munger 2002; Loux et. al 2005). Mowing may be difficult, however, due to Multiflora Rose's preference for steeply sloped terrain.

Chemical control

Many herbicides will not result in complete plant kill of Multiflora Rose, so it is recommended that for best results land managers should combine chemical and mechanical control methods. Spraying or painting cut stems with herbicides (i.e., glyphosate) will expedite control by killing the root systems and preventing resprouting. Herbicides tend to kill Multiflora Rose plants from peripheral roots inward to the crown (Loux et. al 2005), so pulling or mowing the remaining topgrowth eliminates any remaining live plant parts that could asexually reproduce.

Table 1. Herbicides that will provide good to excellent control of Multiflora Rose growing on non-crop sites.

Herbicide Formulation*	Active Ingredient(s)
Roundup Original Roundup PRO Rodeo, Aquamaster (for aquatic sites) Touchdown Others	Glyphosate
Escort XP Patriot	Metsulfuron-methyl
Arsenal	Imazapyr
Crossbow	2.4-D + Triclopyr
Brush Killer Brushmaster	2,4-D + Dichlorprop + Dicamba
Spike 20P	Tebuthiuron
Pathfinder II	Triclopyr (for cut stump and basal bark applications only)
*Consult product labels for details on rate, timing, and method of application and use restrictions	

It is important to select the appropriate herbicide to safely treat Multiflora Rose in the various natural habitats where it is found. Table 1 summarizes herbicides that should have good results in military settings.

Foliar spraying of herbicides in a water carrier is an effective treatment of Multiflora Rose from spring early leaf development through senescence in the fall. Foliar spraying requires the thorough wetting of all plant leaves and green stems with a herbicide that is effective at the time of the growing season that the plants are being treated. Research has shown that foliar sprays of particular herbicides are most effective for controlling Multiflora Rose when applied throughout the growing season, while others may provide acceptable control when applied early in the season (Loux et. al 2005).

Control of Multiflora Rose with glyphosate, result in near-complete, season-long plant kill when applied throughout most of the growing season. The effectiveness is decreased somewhat when applied during July through early September, but when compared to others, these herbicides are the most effective for foliar applications during mid- to late-summer.

Foliar application of Crossbow at a 1.5 percent solution by volume results in an erratic, but still acceptable level of control through June. Later application of Crossbow results in much reduced effectiveness for control of

Multiflora Rose. Research at Pennsylvania State University, Purdue, West Virginia, and Kentucky also indicates reduced effectiveness by Crossbow and other phenoxy containing herbicides when applied in late summer. However, research at Iowa State University and the University of Wisconsin obtained acceptable control from applications of Crossbow in late summer months (Loux et. al 2005). This indicates that phenoxy herbicides, such as, Crossbow, Brushmaster, and Acme Super Brushkiller, may provide more effective growing season-long control of Multiflora Rose in the western parts of the central United States than in areas east of Indiana and Kentucky.

Basal bark spraying is used during the dormant season where a mixture of herbicide and diesel fuel or kerosene carrier is sprayed on the lower 18-24 in. of the stem and crowns of Multiflora Rose. Basal bark treatments can be accomplished using lighter, more mobile spray equipment when compared to foliar applications. The lighter equipment is more suitable for use in steeper terrain where Multiflora Rose is likely to be found. Applications can generally be done when the ground is frozen, provided that there is not a lot of snow or ice that can prevent application to the plant stems and crowns. The basal bark method uses a relatively low volume of spray that is targeted only to the lower portions of the plants. The method reduces the potential of herbicide movement from the application sites and minimizes harm to grasses and other native plants since they are not actively growing during the winter.

The common herbicides used for the basal bark method are Crossbow, Dicamba, Brushmaster, and Acme Super Brushkiller, all of which provide acceptable Multiflora Rose control. Basal bark treatments are effective from mid-December to mid-April in southern Ohio, with complete plant kill occurring in over 50 percent of experiments conducted by Ohio State University (Loux et. al 2005). They conclude that phenoxy containing herbicides are most effective controlling Multiflora Rose when they are applied as a dormant basal bark treatment when compared to foliar application of the same herbicides.

Dormant spot application is another treatment method that can be used during the winter months. Two herbicides are used for the spot application: Dicamba and Escort. Both of these herbicides should be applied when the soil temperatures are below 40^0 F and before the Multiflora Rose plants have begun their spring leafout. The concentration of the herbicides applied depends on the diameter of individual plants that are being

treated. Application while soil temperatures are low is important with dicamba to reduce degradation by soil microorganisms and to ensure adequate root uptake by individual Multiflora Rose plants.

Acceptable results have been reported using the dormant spot application method, however, control of Multiflora Rose has been unacceptable in some experiments conducted at Ohio State University (Loux et. al 2005). Since root uptake of the herbicide is involved, the lack of precipitation after application can inhibit herbicide movement into the soil and reduce the efficacy of this method.

A soil treatment with pellets is also available for Multiflora Rose control, but the herbicide, Spike 20P, is an extremely active, total vegetation control herbicide. The method involves applying the pelleted herbicide near the base of the Multiflora Rose plants. The herbicide will not only kill the Multiflora Rose plants, but will also kill trees, bushes, grasses and other desirable plants if their roots extend into the treated areas. The tebuthiuron in Spike 20P can readily leach down a slope if heavy precipitation occurs before the herbicide has a chance to move into the soil profile.

Cut-stump herbicide treatments with picloram, imazapyr, triclopyr can be used to treat large Multiflora Rose plants that have been cut to near ground level. This method is effective in killing the roots and crowns of the plants and is most useful when only a small number of Multiflora Rose and other brushy plants need to be removed.

Biological Control

Three biotic agents have been identified as destructive pests to Multiflora Rose that may show potential for providing biological control of this invasive plant. Rose rosette disease, rose seed chalcid, and rose stem girdler have all been identified as biotic agents that can reduce Multiflora Rose populations.

Rose rosette disease (RRD), a mite-vectored virus, has received the most attention to date as a possible biological control agent of Multiflora Rose. RRD is carried by the eriophid mite, *Phyllocoptes fructiphilus*, and the disease results in dwarfed foliage, reddened and compact lateral shoots, shortened petioles, and severely reduced flowering and seed production. Smaller infected plants will die within 2 to 3 years of initial infection by the virus, while larger, multi-crowned plants may remain alive for up to 4-5 years.

RRD was first reported on Multiflora Rose in Canada in 1940 and in the Midwestern United States in 1969 in Nebraska (Hartzler 2003). Since then, the disease has been reported to occur in Kansas, Iowa, Colorado, Utah, Missouri, Arkansas, California, Indiana, Illinois, Ohio, Pennsylvania, West Virginia and Tennessee. The disease is capable of infecting most species of the *Rosa* genus, with varying degrees of susceptibility within species. Multiflora Rose appears to be the most easily infected and the most susceptible to the disease of all *Rosa* spp.

The disease spreads most rapidly in dense stands of Multiflora Rose in conditions most favorable to the survival of the mite vector. Plants growing in full sun appear to be more susceptible to the disease than those in shade, and it has been theorized that mites have a preference for stands that have more than 8 hours of direct sunlight per day (Hartzler 2003). In Ohio, for example, wooded areas had the lowest incidence (~25 percent) of RRD infected plants, while nearly 80 percent of the prairie/pasture habitats were infected with RRD (Loux et al. 2005).

RRD has been successfully transmitted by grafting buds and stems of infected plants onto healthy Multiflora Rose plants. Grafting techniques are useful for accelerating natural dispersal of RRD to improve the effectiveness of biological control efforts. The introduction of the infected grafts into dense stands of Multiflora Rose can lead to widespread infection of the population. Grafted plants become colonized by the mites, which in turn spread the disease throughout the treated stands, as well as to nearby populations (Epstein et. al 1997). New RRD infestations can not be expected at significant levels until the second or third year after grafting has been accomplished (Loux et. al 2005).

Rose rosette disease can also infect many ornamental hybrid rose species. The risk of movement of RRD from Multiflora Rose to ornamental rose plants is thought to be low because ornamental roses are often more tolerant of the disease and there is usually a lack of proximity between Multiflora Rose populations and ornamental rose plants. The locality of the infected Multiflora Rose plants needs to be less than 100m to the cultivated rose plants for the disease to spread. Even so, gardeners and horticulturists that grow ornamental rose varieties may be opposed to the use of RRD as a biological control agent of Multiflora Rose.

The rose seed chalcid, *Megastigmus aculeatus* var. *nigroflavus*, a small torymid wasp, has been shown to be widely distributed throughout popu-

lations of Multiflora Rose in the United States. The wasp lays its eggs within Multiflora Rose ovules and the larvae subsequently consumes the seeds of the plant. The chalcid is most prevalent in the eastern United States, but its distribution is limited to areas that do not experience severe cold, since the larvae overwinter in Multiflora Rose hips and may not survive extremely cold temperatures.

Colonization of the wasps into new Multiflora Rose populations is slow because the rose seed chalcids are dispersed with the seed as eggs. Since many Multiflora Rose populations originated from cuttings, the chalcid eggs have not infested established populations of the plant. Researchers, however, believe that the rose seed chalcid is likely to spread in the future, and that will become an effective biological control agent of the Multiflora Rose, especially where rose rosette disease is also present (Loux et al. 2005).

Secondary control science

Fire management

Presumably, periodic prescribed burns will slow Multiflora Rose invasion and establishment, however, information regarding the efficacy of fire management is lacking (Munger 2002). Other *Rosa* species i.e., baldhip rose, prickly rose, and Wood's rose) exposed to fires suffer top-growth loss and, depending on the severity of the fire, may suffer damage to root crowns that will inhibit resprouting. Hruska and Ebinger (1995) reported a significant reduction in Multiflora Rose frequency following two early-spring prescribed burns at a prairie restoration site in east-central Illinois. Specific response of the plant to fire was not described, however.

Biological control

The least important biological control agent of Multiflora Rose is the rose stem girdler, *Agrilus aurichalceus* (Coleoptera: Buprestidae), a beetle whose larvae girdle and can kill individual rose canes. The larvae do not, however, kill entire plants so this agent should be considered in concert with other biological control methods. The dying canes are incapable of asexual reproduction via layering, and, furthermore, developing Multiflora Rose hips and seeds above the girdling will die. The beetle has been found in many states including Ohio, Pennsylvania, Kentucky, Indiana, and, Virginia, West Virginia and may provide some level of biological control in these populations.

Prescribed grazing

Prescribed livestock grazing to control Multiflora Rose in pastures, rangelands and forests is a useful and environmentally-friendly alternative to traditional mechanical or chemical control methods. Luginbuhl et al. (1999) found that grazing by goats alone eliminated Multiflora Rose after four growing seasons in the Appalachian region. When cattle and goats were used, the control effectiveness was reduced to 92 percent elimination, but both grazing strategies resulted in an increase in total vegetative cover, compared to control plots in which vegetative cover decreased significantly (Nader et al. 2007). However, grazing by cattle alone results in only modest control of Multiflora Rose (Luginbuhl et al. 2000), due perhaps to the goats' smaller mouths that allow them to eat around the thorns (Nader et al. 2007).

Even though periodic grazing by livestock in infested areas is an effective control method, overgrazed areas may be more susceptible to colonization from off-site seed sources. When livestock grazing is used as a control method, it should be part of an integrated management plan that accounts for treatment objectives, outcomes, and environmental impacts. These variables cannot be easily predicted. Thus, grazing plans may require adaptive onsite management throughout the growing seasons (Nader et al. 2007).

Emerging control technologies

Near-term

Invasive plant species interactions with native plants often result in a decrease in the abundance and diversity of the native species. This has been attributed to direct resource competition that could displace native species and alter long-term successional processes (Vidra et al. 2007), although they could also enhance the biodiversity of the plant community (Kloor 1999). Invasives may also provide a more complex forest understory and shrub layer, which can affect wildlife both positively and negatively (Vidra et al. 2007). The decrease in abundance of native plant species is often attributed to direct resource competition, but it may also be due to indirect impacts caused by invasive shrubs harboring high densities of seed predators of native plants (Meiners 2007).

In short, the effects of most invasive species (including Multiflora Rose) on species diversity and ecosystem function remains relatively unknown

(Vidra et al. 2007). Additional research is needed to determine how Multiflora Rose competes with native species and what role it fills in the ecosystems it invades. Determining these factors may lead to other control methods, such as prescribed plantings of native species cultivars that can outcompete or slow the invasion of Multiflora Rose infestation.

Long-term

The use of microsatellite genetic markers to determine the genetic variability in populations of Multiflora Rose will help identify the role of genetic diversity in the invasiveness of the plant and its ecological impacts. For example, genetic diversity between populations of Multiflora Rose was found to be high, but genetic distances were not correlated with geographical distances (Gosh and Rocha 2007). Results such as these may lead to a better understanding of the spread and establishment of this invasive plants and may contribute to more effective management.

Finally, recent advances in plant molecular biology and genetic transformation have allowed researchers to create sterile cultivars of invasive ornamental plants (Li et al. 2006). The use of sterile cultivars may reduce or eliminate the rate of invasiveness of Multiflora Rose and preventing future infestations of military lands.

Mission impacts

A recent Department of the Army report to the Senate Armed Services Committee states that Multiflora Rose is one of the major causes of loss of training land use due to vegetation encroachment (Dept. of the Army Report to Congress 2007). Twenty-six percent of the Army installations surveyed reported that Multiflora Rose causes loss of training use of their lands. The major impact to the mission from the presence of Multiflora Rose on an installation is to dismounted troop movements. Because the plant grows in large, dense thickets, possesses large recurved thorns, and can grow to heights of up to 6m, movement through a stand of Multiflora Rose is a very difficult task. The thorns can rip both flesh and clothing as troops navigate through an area infested with Multiflora Rose.

In addition, since the canes are very stout and can grow to long lengths, it is likely that they can get wrapped around parts on vehicles, such as, drive shafts, brake lines, and wheels that could result in damage to vehicles which may result in training downtime for repair. Vehicles may also help

to disperse seeds if traveling through a stand of Multiflora Rose late in the growing season.

Finally, residents neighboring an installation may be concerned about the presence of Multiflora Rose stands on nearby sites. Many people believe that they cannot control Multiflora Rose on their properties as long as it is present on nearby properties. (The plant can be controlled even if it exists on nearby properties, but local landowners often do not believe it.) Also, local gardeners and horticulturists that grow ornamental roses may be concerned with the introduction of rose rosette disease onto an installation in an effort to control Multiflora Rose.

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4 Summary

This work has provided a snap-shot of current research and scientific knowledge related to the invasive plant species Multiflora Rose (*Rosa multiflora*), its impact on the Army, and a concise representation of control technologies for military land managers.

Multiflora Rose is native to eastern Asia (Korea, Japan, and China), but was introduced in the United States in the late 1800s and has since adapted to many North America habitats. Multiflora Rose is adapted to undisturbed areas, such as roadsides, old fields, pastures, fence rows, right-of-ways, stream banks, recreational lands, and forest edges. It does particularly well on steep hillsides and is most productive in sunny areas with well-drained soils.

Effective control of Multiflora Rose requires persistent effort and a determined management plan that may include one or a combination of several methods:

1. Mechanical control
2. Chemical control (herbicides)
3. Biological control (fungi or insects)
4. Fire management
5. Prescribed grazing.

Because the plant grows in large, dense thickets, possesses large recurved thorns, and can grow to heights of up to 6m, Multiflora Rose can causes loss of the use of training lands on Army installations. The major impact to the mission from the presence of Multiflora Rose on an installation is to dismounted troop movements. Military land managers need to be aware that the methods they select to control Multiflora Rose need be effective, and also need to consider surrounding communities' concerns and perceptions regarding the plant and applied control treatments. For example, it is commonly (and erroneously) believed that control Multiflora Rose cannot be controlled if it exists on nearby properties. Also, local gardeners may need to be reassured that an installation's use of biological controls will not affect their ornamental plants.

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14. ABSTRACT

A 2007 Report to Congress documented a crucial factor in the loss of Army training land: uncontrolled vegetation growth. Of the 53 installations surveyed for the report, 30 reported that approximately 12 percent of their training lands were unusable for certain types of training. Uncontrolled vegetation was a source of such problems as an inability to conduct mounted and dismounted maneuver training, interference with equipment used in line-of-sight training, safety issues, and damage to equipment and structures. Of the 11 plant species (or groups) identified by installations as "uncontrolled vegetation," six were invasive plants, of which the two invasive plants most commonly identified were Kudzu (Pueraria montana) and Multiflora Rose (Rosa multiflora). This work provides a snap-shot of current research and scientific knowledge related to the invasive plant species Multiflora Rose, its impact on the Army, and a concise representation of control technologies for military land managers.

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